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AUTHOR McClellan, Elizabeth
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ABSTRACT

The digest examines issues related to the use of technology with gifted and talented students. Computer assisted instruction (CAI) is seen to develop decision making skills and foster independent learning. Applications of four types of CAI to gifted students are explored: drill practice, tutorials, games, and simulations. The use of computers in helping students develop thinking skills is considered, and the impact of computers on creativity, higher level cognitive skills, and problem solving skills is discussed. A final computer application, as a tool for facilitating independent learning, is explored in terms of data processing for student research, word processing, art and music creation, authoring systems, and networking. (CL)

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Clearinghouse on Handicapped
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1920 Association Drive,
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TECHNOLOGY FOR THE GIFTED AND TALENTED

In general, computers are used in the education of gifted children in three ways: in computer assisted instruction (CAI), in developing thinking skills, and as tools for facilitating independent learning.

Computer Assisted Instruction (CAI)

The role of computer assisted instruction in the education of gifted children is to develop decision-making skills and to foster independent learning. In CAI, the computer presents information, asks questions, and verifies responses in much the same way a teacher does. Unlike traditional means of instruction, however, CAI allows students to work at their own level and pace. This mode of instruction can be very beneficial to gifted students who often have interests and abilities that go beyond the scope of the regular curriculum.

Drill and Practice. Drill and practice programs provide students with practice using material they have already encountered. Because these programs cover various levels of many subject areas, they can be used for both remediation and acceleration. Gifted children do not necessarily excel in all areas; they may need help mastering some subjects. Drill and practice programs help to reinforce recently acquired knowledge and skills. For gifted students, the primary role of drill and practice programs is to help students who want to go beyond the lockstep curriculum acquire new skills.

Tutorials. Tutorials are used to teach new information. Typically, a program presents a body of information and then questions the student on that information. Like drill and practice programs, tutorials can be a form of enrichment for gifted students who want to explore areas of content that may not be in the regular curriculum. Tutorials are also a means of accelerating content. If, for example, a gifted student can and wants to learn Algebra I in a shorter period of time than his or her classmates, tutorials provide a means for doing so.

Games. There are two categories of games that may be appropriate for gifted children: adventure games and mind-teasers. Adventure games put the player in situations in which he or she has to use problem-solving skills and creative strategies to overcome obstacles. The player must provide explicit directions to the computer. Adventure games can also help students develop prediction skills. Students learn very quickly to evaluate all possible outcomes before making a move. Mind-teasers are often the computerized version of conventional games such as chess, backgammon, or *Master Mind*.

Computer games are an excellent source of motivation, but they seldom have high content value. Since most stu-

dents willingly spend hours on an educational game, their use must be monitored by a teacher.

Simulations. Simulations are among the most powerful learning tools for gifted children. They are based on the discovery approach to learning, that is, learning by doing. Simulations provide situations that are analogous to real situations, but they control limiting factors that exist in the real situation such as danger, expense, time, and space. Since simulations can be repeated, students can see the effects of using different strategies in solving the problems presented by the program.

How Are Computers Used to Develop Thinking Skills?

One of the major goals of programs for the gifted is to help students develop higher level cognitive skills, problem-solving skills, and creativity. Through the use of programs designed for these purposes, and by learning to write programs, students can develop modes and strategies of thinking that will affect the way they think in situations that are not related to the computer.

Gifted children are believed to be particularly adept at learning to use the cognitive skills of analysis, synthesis, and evaluation. Analysis refers to the ability to break a skill or conceptual structure into its components. Synthesis is the building of complex skills or conceptual structures from simple parts. Evaluation calls for the comparison of skills and structures and the making of judgments about them (Bell, 1981). Some games and simulations are aimed at helping students develop these skills.

Creativity involves another kind of thinking—divergent thinking. As is the case with the development of cognitive skills and problem-solving skills, students can explore their creative potential by using software that is designed specifically for that purpose or by creating their own unique and interesting programs. Some programs encourage students to write poetry, compose music, or draw pictures. Other programs show students how to develop strategies for creative writing.

Teaching children to write computer programs also helps to develop thinking skills. Students are taught that a computer is very similar to the human mind. The steps that a computer goes through in running a program are similar to the steps a person goes through in solving a problem of logic. When students learn to see the analogies between the computer and the brain, they begin to see how they can apply computer logic to other kinds of problem solving.

In programming, there are two kinds of problems to be solved. The first centers on the steps involved in writing a program. Students learn to break a problem into its components and to tell the machine how to deal with each of the

components. The second kind of problem involves "debugging" the program, that is, solving the problems that are related to the logic and sequencing used in creating the program. Both kinds of problem solving require the use of thinking skills associated with analysis, synthesis, and evaluation.

How Does the Computer Serve As a Tool for Gifted Students?

Processing Data. One of the goals of educational programs for gifted children is to foster independent learning. To achieve this goal, students are encouraged to conduct their own research. An example of such a program is found at the Talcott Mountain Center in Connecticut. At this center, gifted students conduct experiments on wind speed and direction by tracking helium-filled weather balloons. Students use the computer to analyze the data from their experiments (Barstow, 1979).

Word Processing. Word processing has changed the way composition is taught. Before the age of the microchip, writing and rewriting were often troublesome, especially for students who have poor handwriting or those who demand perfection in their work. Word processing packages greatly facilitate students' efforts to make editorial changes, thereby reducing their reluctance to rewrite compositions.

Creating Art and Music. Students can create works of art on the computer in several ways. Some software packages allow students to use either the keyboard or a joystick as a paintbrush. Not only colors, but textures and brush strokes can be controlled. In addition to programs, students can use graphics tablets to create designs. Students place light pens at various points on a tablet, and the corresponding design appears on the screen.

Music can also be created on the computer. Some programs let users enter notes and specify their parameters (octave, duration, dynamic level, articulation); compositions can be written for up to four independent voices.

Electronic keyboards make writing music easy for students who play the piano. Like graphics tables, keyboards are peripherals that can be interfaced with a microcomputer. As a user plays the keyboard, the notes and parameters are temporarily stored in memory. The piece can then be saved on a disc for later use or further alteration.

Authoring Systems. Authoring systems and languages allow users to create computer programs even if they know very little about conventional program languages. Typically, authoring programs allow the user to create drill and practice or tutorial programs. Authoring systems can also be used by gifted students who want to create interactive software without going through the usual stages of programming. As is the case with many tutorials, software created with authoring systems presents a narrative, asks a

question, waits for a response, and provides a reinforcing statement. Many authoring packages include features such as graphics, branching, and score keeping.

Networking. In its most simple form, a network is like a grapevine: one person shares information with a second person, who passes it on to a third. The age of technology has greatly expanded human capabilities for sharing information.

Because gifted children often have interests that lie beyond the scope of traditional school curricula and resources, they can benefit tremendously from networking. In some instances gifted children form their own networks; in other cases, they can hook into networks established by other individuals, organizations, or businesses.

The real power in networking lies in the capability of microcomputers to communicate with other computers. To do this, a microcomputer is attached to a modem, which is an electronic device that converts the computer's binary code to auditory signals that can be sent through telecommunications systems to other computers. By using telecommunications, students can contact large data banks, information services, or electronic bulletin boards. Electronic bulletin boards function essentially in the same way as traditional corkboards. A user can post a message asking for information or send a message to other members of the network. Networking helps put students and teachers in contact with resources outside their immediate environment.

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Prepared by Elizabeth McClellan, Coordinator, Project RETOOL, The Council for Exceptional Children.

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